DNA, or Deoxyribonucleic Acid, is the genetic material of nearly all living organisms on the planet Earth and, as such, can be called the basic building block of life (although Lego probably comes a close second). In 1953, James Watson and Francis Crick unveiled their discoveries about DNA and the double helix model, which formed the basis of genetic coding.

DNA - A Brief Description

DNA is located in the cell nucleus as the basic structure of the genes, and is composed of two strands of nucleic acid made up of units called nucleotides, wound around each other to form a double helix shape.

Nucleic acids, called that because they were discovered in cell nuclei, are long organic polymers that contain carbon, hydrogen, oxygen, nitrogen and phosphorus, forming the inherited genetic material inside each cell. In humans, each gene is a segment of DNA and controls protein synthesis, regulating most of the activities that take place in the cells.

The DNA molecule can make exact copies of itself by the process of replication, thereby passing on hereditary information - so determining all physical (and some would argue, personality) traits. This enables DNA to be used to identify gender, hair and eye colour, and other genetic markers such as common ancestry or whether you have a predisposition for hairy armpits.

Extraction of DNA

With a few simple bits and pieces found about the home, you can extract and have a look at DNA1. The method explained below is a home-science experiment that has its basis in the 'Marmur' preparation used by biotechnology laboratories the world over. So you can do it at home safely without fear of breaking any United Nations Conventions or blowing up the kitchen.

As said, there is no real risk attached to extracting DNA at home, so that when someone asks (usually a small, inquisitive child), 'What's DNA?', not only can you point them in the direction of a suitable book, magazine or website, you can actually show them the stuff itself - proving it does exist!

You can extract DNA from fruit and vegetables like peas, broccoli, onions and even kiwi fruit (in fact any living organism, although next door's cat or dog isn't recommended) - but human DNA extraction is probably the most fun, and the grossest.

'I Need a Swab'

The world of television is especially keen on the concept of DNA fingerprinting; many modern crime dramas have the main protagonists swabbing the inside of suspects' cheeks with small sterile cotton balls on the ends of especially long cocktail sticks to extract cells. The resulting cellular information obtained to aid in DNA profiling usually leads to the villain being accused of a crime, finding out they're related to someone obscure, or that they're actually not what they seem (for example: while they look like a man, they're actually a woman, or an alien).

Away from the television, though, the harmless procedure of obtaining a DNA sample can be done without fear of laboratory test results proving you're the milkman's heir. To extract DNA at home you will need the following:

\*

saline solution (a glass of salty water)

\*

a clean glass

\*

1 tsp (5ml) washing-up liquid/detergent

\*

3 tsp (15ml) tap water

\*

a clean teaspoon

\*

a bottle of ice-cold alcohol (gin or vodka are excellent, as many people keep these in the freezer2. If you don't have strong booze available, any alcohol will do, such as rubbing alcohol.)

\*

a gobful of spit

Method

1.

Swill out your mouth with the saline solution for about 30 seconds. This is to collect the DNA contained in your saliva, and around the walls of your cheeks. You can also extract DNA from blood, hair, skin or even semen too, but the techniques for obtaining these types of samples are more difficult to do at home without more complex equipment (although perhaps slightly more interesting in their collection).

2.

Spit the contents of your mouth into a glass containing a mix of three teaspoons of water and one teaspoon of washing-up liquid/detergent. You are thus (hopefully) transferring the DNA from your cheek cells into the solution.

3.

Stir this mix slowly and gently (scientists use the fancy term 'mechanical agitation') for a couple of minutes. During this process it is necessary to break up tissue (in this case, cheek cells) mechanically, and then to degrade both the cell membranes and those surrounding the nuclei - releasing the DNA contained within them3.

4.

Now pour (slowly!) some of the ice-cold alcohol carefully down the inside of the glass, allowing it to settle on top of the solution. DNA is insoluble in cold alcohol and while there will be a few bubbles, the other compounds in the mixture will dissolve, and the DNA will separate from the other ingredients. Leave it for about two to three minutes for this to happen4.

5.

If you are lucky you will see a spindly white substance, maybe clumps of it if you are really careful, forming on top of the salt/detergent mixture. Be patient - it will happen slowly. The resulting 'goo' is unique to you; it is your very own DNA!5

You can, if you wish, try taking the string of DNA out to investigate further. To do this a thin, long tool like a kebab skewer or firm plastic straw will do the job. Simply stick the utensil in the mess and twist it slowly, the DNA strands will wrap around it. You must do this very carefully as the DNA is extremely fragile.

Once you have DNA strands out you can poke them, prod them or stick them under a microscope. You could try staining the DNA to make it easier to look at under the microscope, or you could even test its acidity with some natural pH indicators like beetroot and red cabbage. Whatever you do though, make sure you dispose of the results properly. Don't drink the concoction, or sell it off to a strange-looking chap in a dirty white labcoat who mentioned something about cloning...

**Practice quiz - DNA structure and replication**

Principio del formulario

**Please enter your name** 

Final del formulario

**Directions: Choose the best answer for each of the following questions. When you are finished, click on the "Ready to be graded" button.**

Principio del formulario

**1. Molecules of DNA are composed of long chains of**

amino acids

fatty acids

monosaccharides

nucleotides

Final del formulario

Principio del formulario

**2. The primary function of DNA is to**

make proteins

store and transmit genetic information

control chemical processes within cells

prevent mutations

Final del formulario

Principio del formulario

**3. A nucleotide consists of**

a sugar, a protein, and adenine

a sugar, an amino acid, and a starch

a sugar, a phosphate group, and a nitrogen-containing base

a starch, a phosphate group, and a nitrogen-containing base

Final del formulario

Principio del formulario

**4. The part of the molecule for which deoxyribonucleic acid is named is the**

phosphate group

sugar

nitrogen base

none of the above

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Principio del formulario

**5. Purines and pyrimidines are**

bases found in amino acids

able to replace phosphate droups from defective DNA

names of specific types of DNA molecules

bases found in nucleotides

Final del formulario

Principio del formulario

**6. The scientists credited with determining the structure of DNA are**

Avery and Chargaff

Hershey and Chase

Mendel and Griffith

Watson and Crick

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**7. The base-pairing rules state that the following are base pairs in DNA:**

adenine - thymine; guanine - cytosine

adenine - thymine; uracil - cytosine

adenine - guanine; thymine - cytosine

uracil - thymine; guanine - cytosine

Final del formulario

Principio del formulario

**8. ATTG : TAAC ::**

AAAT : TTTG

TCGG : AGAT

GTCC : CAGG

CGAA : TGCG

Final del formulario

Principio del formulario

**9. The enzymes responsible for adding nucleotides to the exposed DNA template bases are called**

replicases

helicases

DNA polymerases

nucleotidases

Final del formulario

Principio del formulario

**10. All of the following are TRUE about the structure of DNA** **except**

every DNA nucleotide contains a sugar, a phosphate group, and a base

short strands of DNA are contained in chromosomes inside the nucleus of a cell

DNA consists of two strands of nucleotides joined by hydrogen bonds

the long strands of nucleotides are twisted into a double helix

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